

INNOVATIVE USE OF OUTDATED DOXYCYCLINE HYDROCHLORIDE TO DYE WOOL

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ABSTRACT

Doxycycline is a synthetic broad-spectrum antibiotic used to treat many different bacterial infections, such as infections of urinary tract, acne, gonorrhea, chlamydiosis, periodontitis (gum disease), blemishes, bumps, and acne-like lesions caused by rosacea.

Taking outdated Doxycycline can cause serious side effects. Therefore outdated Doxycycline hydrochloride drug should be thrown out or discard if there is any leftover. Discarding unused, or expired Doxycycline in the toilet is a common practice. But this method may not be any safer than throwing in the trash, because it still is contaminating water supply.

Deposing of such drugs is a major problem in today's pharmaceutical Industries. In view of this the present study used the unused Doxycycline Hydrochloride Drug in textile processing.

Reuse of outdated Doxycycline to dye Wool by this method can keep unused Doxycycline medication from being illegally abused or sold.

This method can solve two major environmental and economical problems: limitation of environmental pollution with pharmaceutically active compounds and reduction of the disposal costs of expired drugs.

KEYWORDS: Doxycycline, Periodontitis, Bacterial Infections, Wool

INTRODUCTION

Doxycycline is a synthetic broad-spectrum antibiotic used to treat many different bacterial infections, such as infections of urinary tract, acne, gonorrhea, chlamydiosis, periodontitis (gum disease), blemishes, bumps, and acne-like lesions caused by rosacea.

Taking outdated Doxycycline can cause serious side effects. Patients should not take these medicines if:

- The color, appearance, or taste have changed
- The drug has been stored in a warm or damp area
- The expiration date on the label has passed

Therefore outdated Doxycycline drug should be thrown out or discard if there is any leftover. Discarding unused, or expired Doxycycline in the toilet is a common practice. But this method may not be any safer than throwing in the trash, because it still is contaminating water supply. Therefore, our study was focused on the usage of expired Doxycycline

Hydrochloride drug or unused Doxycycline Hydrochloride drug. In our previous study, Silk, Nylon, Wool and Jute have been successfully dyed with Tetracycline hydrochloride as well as Nylon and wool dyed with Doxycycline Hydrochloride by exhaust process.¹⁻⁶ In this work we made successful attempt to dye silk fabric with outdated Doxycycline.

This method of unused medicines valorization can solve two major environmental and economical problems: limitation of environmental pollution with pharmaceutically active compounds and reduction of the disposal costs of expired drugs. Collection of unused or outdated Tetracycline can be done by various methods like community take back programs and further can be use to dye Wool which can keep unused Doxycycline medication from being illegally abused or sold.

MATERIAL AND METHOD

Material

Commercially available ready for dye (RFD) silk fabric was used for the study.

Drug Used

Doxycycline Hydrochloride (Trade name -Doxylab), by Laborate Pharmaceutical India Ltd, H.P., India.

Chemicals

Hydrochloric Acid(HCL) , Ammonium Acetate (CH₃COONH₄), All chemicals are supplied by S.D. Fine Chem. Ltd. and are of AR grade.

METHODS

Dyeing of Wool

1% stock solution of Doxycycline Hydrochloride was prepared for dyeing. Wool was dyed with Doxycycline hydrochloride keeping liquor ratio of 20:1, at 100°C for 60 min. Then rinsed and dried.

Colour Measurement

Dyed samples were evaluated for the depth of the colour by determining K/S values using a Spectraflash® SF 300, Computer Colour Matching System supplied by Data color International, U.S.A. An average of four readings taken at four different sample areas was used to calculate the reflectance values, and Kubelka Munk K/S function which is given by:

$$\frac{K}{S} = \frac{(1 - R)^2}{2R}$$

Where,

"R" is the reflectance at complete opacity.

"K" is the absorption coefficient.

"S" is the scattering coefficient.

Tone of the Colour is also measured on the same machine Tone of the Colour in terms of CIE L*a* and b* values.

Washing Fastness was carried out by ISO 105-CO1

Light Fastness was carried out by ISO 105-B02

Rubbing Fastness was carried out by ISO 105-X12

RESULTS AND DISCUSSIONS

Doxycycline is a common antibiotic. The waste of unexploited, unused or expired Doxycycline drugs contributes to a large extent. Thus the above project throws an innovative light of using the outdated Doxycycline drugs in textile processing especially in dyeing of Wool. The above experimentation has exhibited the uniform level dyeing with a wide gamut of colors with increasing concentration.

Drugs lose their potency beyond their expiration date, and therefore their effectiveness and their ability to dissolve can be affected. For patients who rely on medications to stay alive, like heart medications, expired drugs can be dangerous because they may not be getting the full effectiveness of the drug. It depends on the medication.

The present work has used Doxycycline hydrochloride an antibiotic for dyeing of Wool fabric. At the outset the Wool fabric was dyed at 100°C for 60 min and the concentration was varied between 0.5% to 3% and the results are shown in Table 1.

Table 1: Colorant Strength Calculation Values of Wool Substrate Dyed with Doxycycline Hydrochloride

Sr. No	DCH Conc. %	L*	a*	b*	C*	H*	Colour Strength (%)	K/S
1	0.5	60.203	4.288	12.821	13.519	71.479	100	2.0223
2	1	59.538	4.656	13.088	13.892	70.389	125.481	2.5376
3	2	59.661	4.701	13.594	14.384	70.895	233.874	4.7297
4	3	60.31	4.594	14.101	14.83	71.926	249.172	5.039

Table 2: Fastness Properties of Wool Substrate Dyed with Doxycycline Hydrochloride

Sr. No.	DCH % Shade	Washing Fastness	Light Fastness	Rubbing Fastness	
				Dry	Wet
1	0.5%	3-4	5	5	4-5
2	1%	3-4	5	5	4-5
3	2%	3-4	5	5	4-5

The Doxycycline drug is light-yellow in color. On varying the concentration of Doxycycline solution used for dyeing a wide range of shade of color was obtained. Table 1 indicates that as the L value decreases 0.5 % to 1% and then slightly increase upto 3% hence the darkness increases and become maximum at 1% and when concentration of Doxycycline increases more from 1% to 3% the L value increases and become maximum at 3%, hence as the concentration of Doxycycline increases the lightness characteristic initially increases and become maximum at 3%. The value of a* found to be increasing from 0.5% to 2% and further decreases from 2% to 3% as the concentration increases.

Hence it can be observe that as the concentration increases the Redness characteristics increases initially and become minimum at 2% then after redness characteristic found to be decreasing at 3%. The value of b* increases from 0.5% to 3% and become maximum yellower at 3% which indicate that yellowness increases as increase in %shade and its minimum at 3%. From the table 1 it has been observed that the Colour Strength increases and maximum at 3%. The K/S values also increases with the increase in concentration as shown in table 1. Thus Doxycycline drug can be used to dye Wool fabric by the exhaust process. The light fastness as seen in table 2 is good, indicating ionic bond linkages which are

faster to light. The successful dyeing of Wool by using a drug which has expired potency for human consumption can be recycled to dye the Wool fabric instead of polluting the effluent and the whole process is environmental friendly and a very good alternative for the use of the expired Doxycycline drug. The End-use can be in various sectors in apparels, technical textile, medical textile etc.

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